Standard Operating Procedure

for

Heavy Hydrocarbon Sampling Using Tenax Cartridges during Intensive Operating Periods in CRPAQS

Prepared By:
Desert Research Institute
2215 Raggio Parkway
Reno, NV 89512

1.0 DRI 6-CHANNEL TENAX SAMPLER

1.1 The Tenax Sampler has been developed for routine sample collection. The apparatus is housed in Pelican Case. shows the flow chart of the Tenax sampler. Figure A-2 is a diagram of the Tenax sampler system.

1.2 A diaphragm pump provides a sampling capacity of approximately 20 liters per minute at a vacuum of 20 inches of mercury. A relief valve is used to maintain a steady vacuum for the sampler. The sampler will accommodate up to two individual flow control modules each capable of drawing two sorbent tube sample. Flows are set by means of fine metering valves.

1.3 For automatic operation, 7-day Grasslin controller timer is wired to start and stop the pump at appropriate times for the desired sample period, and open and close the sample line inlet.

2.0 FLOW CALIBRATION

The Tenax Sampler contains two calibrated components; a vacuum relief valve and six flow control modules. Each component must be individually calibrated at the beginning of a special ambient air study, and thereafter at intervals not exceeding two years. Calibration is also required for components failing performance audits or subject to repair.

2.1 Vacuum Relief Valve (Preset before going into field)

The vacuum relief valve is set to 20 ± 0.5 in Hg.

Materials required:

Allen hex wrench

2.1.1 Turn on pump and observe vacuum.

2.1.2 Adjust relief valve as necessary to obtain 20 ± 0.5 in Hg. Tighten lock screw. [Note: The pressure setting generally increases slightly as the lock is tightened. Experience shows that a setting of approximately 19.5 in Hg will increase to the desired value when locked.

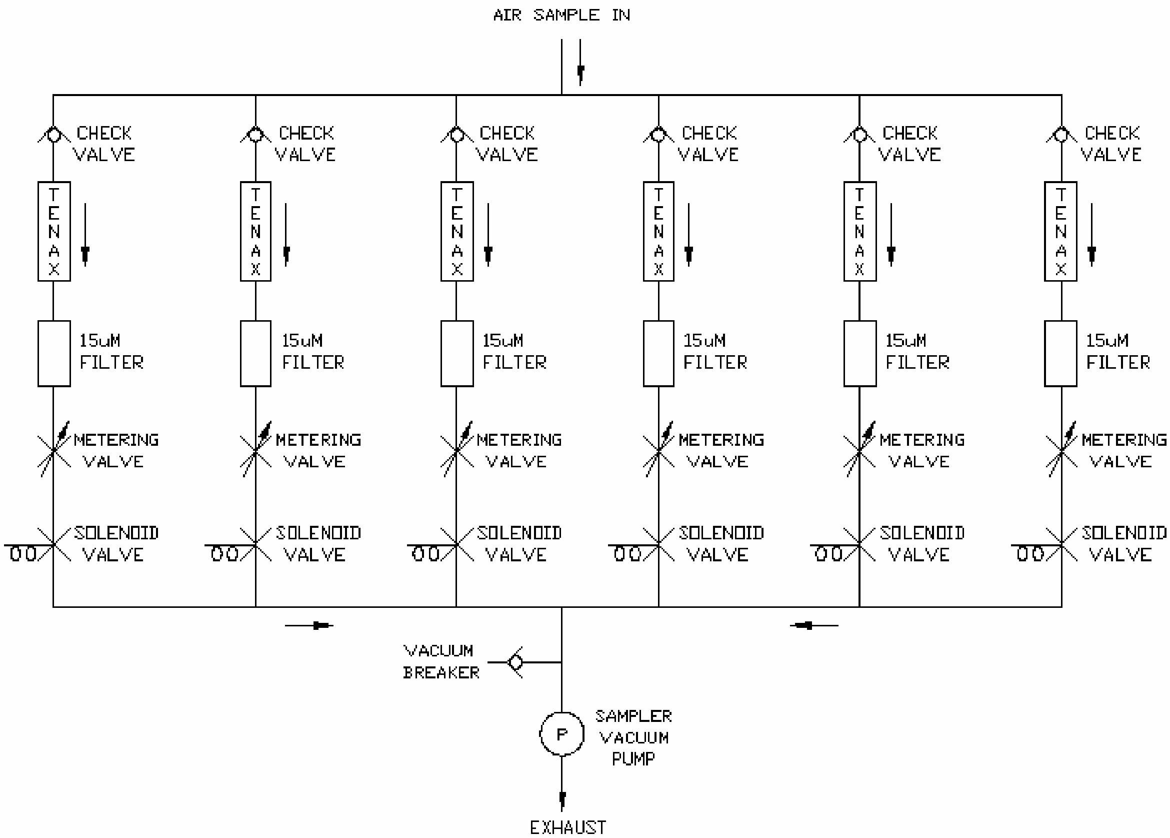

Figure A-2. Tenax Sampler Diagram.

2.1.3 Retest vacuum and readjust as necessary.

2.1.4 Turn on vacuum pump; allow at least one minute for system to stabilize. Check vacuum gage. Vacuum must be 20 ± 0.5 in Hg. If not, adjust relief valve before proceeding.

2.1.5 Set module metering valve to nominal flow by reference to bubble meter or electronic flowmeter.

2.1.6 Make five flow observations on flow meter. Record observations on Tenax Flow Control Module Calibration Form, Figure A-3. Calculate average.

2.2.5 Correct measured flow to standard conditions: 25 °C, 760 mm Hg.

$$\text{corrected flow} = \text{measured flow} \bullet \frac{\text{Temp}\ ^{o}\text{C} + 273.15}{298.15} \bullet \frac{760\ \text{mm Hg}}{\text{atmospheric pressure}}$$

2.2.7 File calibration data in project file.

Data Log Sheet
TENAX SAMPLER

Sampler I.D.: ______________________________ Sample Date ________________________

Sample Location: (Bore #) ______________________ (Site) ______________________________

Sample Time: Start: ________________________ Stop: ______________________________

Elapsed Timer: Start: ________________________ (Hours) ___________________________________ (Minutes)

Stop: ________________________ (Hours) ___________________________________ (Minutes)

Flow Measurement Module I.D.: ___________________________

$$Q_A = 0.375 \text{ LPM} = 375 \text{ ccm}$$

$$Q_S = Q_A \left(\frac{P_A}{P_S} \frac{T_S}{T_A} \right) = (V - B)/M$$

$$V = M\, Q_A \left(\frac{P_A}{P_S} \frac{T_S}{T_A} \right) + B$$

$$M = 0.0009984$$

$$B = -0.0128$$

VOLTAGE = _________________

Port I.D.	Tube I.D.	Voltage Flow: ON	Voltage Flow: OFF
A			
B			

Check Before Sampling:
- Timer program installed
- Tenax tubes are tight in holders

Check During Sampling:
- Light on sampling valve is on

Check After Sampling:
- Cover TENAX holders sampling valve with aluminum foil until next run

Comments:

____

Operators: Start: __________ Stop:

Figure 3. Tenax Sampler Data Log Sheet.

3.0 TENAX SAMPLE COLLECTION

3.1 Prior to sample collection insure that the sampling flow rate has been calibrated over a range including the rate to be used for sampling as described in Section 2.0.

3.2 The flow rate is checked before and after each sample collection. To check the flow, attach the flow measurement hose on the inlet of the sorbent tube. Allow at least one minute for pressure stabilization. Record flow meter readings. Remove hose, turn off pump.

3.3 To collect an air sample the cartridges are removed from the sealed container just prior to initiation of the collection process. If glass cartridges are employed they must be handled only with polyester gloves and should not contact any other surfaces.

3.4 If required, a particulate filter and holder are placed on the inlet to the cartridges. If two Tenax cartridges are connected in series (to check for a break-through) the exit end of the second cartridge is connected to the sampling apparatus. Cartridges are connected using Teflon ferrules and Swagelok (stainless steel or Teflon) fittings.

3.5 Allow the sampler to operate for the desired time.

At the end of the sampling period check the flow rate and record the value. If the flows at the beginning and end of the sampling period differ by more than 10% the cartridge should be marked as suspect.

3.6 Remove the cartridges (one at a time) and place in the original container (use gloves for glass cartridges). Store cartridges at reduced temperature (e.g. - 20°C) before analysis, if possible, to maximize storage stability.

3.7 Calculate and record the average sample rate for each cartridge according to the following equation:

$$Q_A = \frac{Q_1 + Q_2 + \ldots Q_N}{N}$$

where:

Q_A = Average flow rate in ml/minute.
Q_1, Q_2, ...Q_N = Flow rates determined at beginning, end, and immediate points during sampling.
N = Number of points averaged.

3.8 Calculate and record the total volumetric flow for each cartridge using the following equation:

$$V_m = \frac{T \times Q_A}{1000}$$

where:

V_m = Total volume sampled in liters at measured temperature and pressure.
T_2 = Stop time.
T_1 = Start time.
T = Sampling time = T_2 - T_1, minutes.

3.9 The total volume (V_s) at standard conditions, 25°C and 760 mm Hg, is calculated from the following equation:

$$V_s = V_m \times \frac{PA}{760} \times \frac{298}{273 + t_A}$$

where:

P_A = Average barometric pressure, mm Hg.
t_A = Average ambient temperature, °C.